HELSINGIN YLIOPISTO
HELSINGFORS UNIVERSITET
UNIVERSITY OF HELSINKI

FACULTY OF PHARMACY

Annual review 2007

Contents

Dean's overview

Dean's overview of the Faculty of Pharmacy for the anniversary year 2007

The year 2007 marks 110 years since pharmaceutical studies began at the University of Helsinki. The faculty celebrated its long academic history on 10 December 2007 with a large crowd of invited guests.

The future also looks promising, as 2007 was a productive year. The faculty achieved all of its quantitative goals for degrees and was named a quality unit of education of the University of Helsinki for the years 2007–2009.

Ensuring compliance with the university's new strategic development foci and common goals required substantial energy over the year. One of the key development issues was quality control. In anticipation of quality assurance audits organised by the Finnish Higher Education Evaluation Council, the faculty, departments, DDTC (Drug Discovery and Development Technology Center), and research groups prepared quality policies and guidelines. The Faculty of Pharmacy was one of the university faculties selected for auditing.

One of the most significant events in terms of research was the solidification of the status of the DDTC. A stronger international presence in our research and teaching staff was also evident: in 2007, the proportion of international teaching and research personnel rose to 13.6 percent. Professor **Raimo Tuominen**'s research group played a key role when Professor **Mart Saarma**'s research group discovered a new cholinergic neuronal differentiation factor (CDNF) that protects the dopamine neurons in rat brains and prevents their degeneration in an experimental model of Parkinson's disease. The study was published in *Nature.*

An important moment during the year was the "Taskinen Symposium on Drug Design and Metabolism", an international symposium held in memory of our late colleague **Jyrki Taskinen**, Professor of pharmaceutical chemistry.

In terms of societal involvement, development and maintenance efforts continue to receive emphasis in the faculty's already-strong cooperative relationships with pharmacies, hospitals, pharmaceutical institutions, the National Authority for Medicolegal Affairs, industry unions, the Pharmaceutical Learning Centre and partner universities. Monthly morning coffee breaks are a new institution aimed at increasing both interdepartmental interaction and internal communication.

During 2007, 149.3 personnel years were completed; budgetary funding was 5.8 million euros, and supplementary funding came to 4.1 million euros, approximately 41% of the faculty's entire financing. In addition, the Faculty of Pharmacy and the Faculty of Agriculture and Forestry were given a combined university lectureship. Faculty staff were granted numerous awards and honorary mentions; these are presented in greater detail in the pages that follow.

Dean Raimo Hiltunen

Highlights 2007

Faculty designated a centre of excellence in teaching

Rector **Ilkka Niiniluoto** disbursed performance-based funding for the years 2007–2009 to various university units based on the quality of their teaching. The Faculty of Pharmacy was honoured to be named one of five centres of excellence. Among the grounds for the recognition was the fact that teaching in the Faculty is continuously developed on the basis of feedback and experiences. A variety of teaching methods are used and their applicability is discussed as a group.

Pharmacy celebrates 110th anniversary

In December of 2007, the Faculty held a celebration in honour of 110 years of pharmaceutical education at the university. Vice-Rector **Hannele Niemi** noted that the university's instruction in the field has kept up with developments in Europe, even leading the way. Stakeholders and cooperating partners paid their respects and congratulated the Faculty.

The Taskinen Symposium on Drug Design and Metabolism

The Faculty organised the Taskinen Symposium on Drug Design and Metabolism in honour of Professor **Jyrki Taskinen**, who passed away the previous year. The main topics were COMT, UGT and SULT enzymes, which transfer certain atom groups between molecules.

Raimo Hiltunen wins the Albert Wuokko Award

Faculty Dean **Raimo Hiltunen** was granted the Albert Wuokko Award for excellence in developing teaching and research in the field of pharmacy. The prize is one of the most esteemed in the field and is granted to those who have demonstrated decisive and pioneering work towards the improvement of pharmaceutical instruction and research.

A prominent pharmaceutical prize

Professor **Jouni Hirvonen** was awarded the CRS / Eurand Grand Prize Award on the basis of his presentation given at the annual Controlled Release Society congress held in the USA. Emphasised in the prize criteria was the significance of research that solves problems related to drug production and drug delivery at the industry-wide level.

Jouko Yliruusi granted research award

The European Federation for Pharmaceutical Sciences (EUFEPS) granted the New Safe Medicines Faster Award to Professor **Jouko Yliruusi** for his pioneering work in the application of PAT (Process Analytical Technology) to drug formulation and process research. The award is granted annually to a researcher or research group that has shown merit in developing new methods or technologies for accelerating or increasing the efficiency of drug production processes.

Teaching in the Faculty is continuously developed on the basis of feedback and experiences.

The Faculty held a celebration in honour of 110 years of pharmaceutical education at the university.

International dissertation award to Jaakko Aaltonen

The American Association of Pharmaceutical Scientists (AAPS) recognised **Jaakko Aaltonen**, who defended his dissertation in the Faculty in 2007, for his dissertation research. The award was granted in the Analysis and Pharmaceutical Quality category on the basis of exceptional and applicable research results.

Neurotrophic factor research published in Nature

The research group led by **Mart Saarma**, Director of the Institute of Biotechnology, discovered a new neurotrophic factor (CDNF). Together with the research group led by **Raimo K. Tuominen**, they were able to demonstrate that CDNF protects midbrain dopamine neurons from damage in rats and even facilitates the restoration of functioning to earlier levels. The results were published in the scientific journal *Nature.*

A new compound for early-stage drug development

German researcher **Ingo Bichlmaier** and his research colleagues created a compound that can accelerate early-stage drug development and also aid in the identification of various drug-drug interactions. The research results were published in the Journal of Medicinal Chemistry and in ChemMedChem. Bichlmaier is wrapping up his doctoral dissertation in **Jari Yli-Kauhaluoma's** medicinal chemistry and docent **Moshe Finel's** molecular biology research groups.

Significant funding for doping research

Researchers from the University of Helsinki and United Laboratories Ltd received significant amounts of funding from WADA (the World Anti-Doping Agency) to study metabolites of aromatase inhibitors and anti-estrogenic compounds that are used as doping agents.. In the Faculty of Pharmacy, the project receiving the funding is led by Professor **Jari Yli-Kauhaluoma**.

Yvonne Holme named Teacher of the Year

University lecturer and docent **Yvonne Holm** was named Teacher of the Year by the University of Helsinki's Palmenia Centre for Continuing Education. Holm's clear, practical, useful, and inspiring approach to instruction were noted in the grounds for the award, as was her prompt feedback on course work.

Birch bark – white gold for the pharmaceutical industry?

Birch bark shoes kept Finnish feet dry in earlier times, and the antiseptic properties of birch bark have been recognised for ages. Xylitol, produced from birch xylose sugars, was a bull's-eye result from research conducted in the 1970s. The betulin that exists in birch bark gives hope for similar breakthroughs in the future; properties that combat inflammation, cancer, and different kinds of bacteria have been noted in betulin derivatives.

Professor **Jari Yli-Kauhaluoma's** group does research in a variety of medicinal chemistry topics. The group has participated, for instance, in an EU initiative studying compounds affecting protein kinases and is developing compounds for combating pneumonia caused by *Chlamydia pneumoniae*. Metabolic research of pharmaceutical substances is one of the traditional strengths of the Division of Pharmaceutical Chemistry, and research into birch bark is one of the research directions that excites Yli-Kauhaluoma the most.

Surprising results from betulin derivatives

Betulin, extracted from birch bark, is a well-known and much-researched compound. Development of betulin derivatives, on the other hand, is groundbreaking work at the moment.

"Betulin has become an important and inspiring topic of research for the group. It was somewhat surprising that we were able to discover such a wide range of bioactives by chemically modifying betulin," says Yli-Kauhaluoma.

Betulin's abundance and cheapness increase its appeal as a raw material. At the moment, birch bark waste is inefficiently used; most of it is wet burned to generate energy. The amount of birch bark waste produced by the wood industry in Finland alone would suffice to meet the needs of the pharmaceutical industry. Adjunct Professor **Salme Koskimies** from the VTT Technical Research Centre of Finland, who is cooperating on the birch project, has investigated the large-scale use of birch bark in other industries.

Some betulin derivatives have previously been discovered as having anti-inflammatory and anti-HIV properties. For instance, the effectiveness of betulin derivatives prepared by researcher **Sami Alakurtti** has been tested against alphaviruses at the DDTC (Drug Discovery and Development Technology Center) and the Institute of Biotechnology. Their effects on worms that cause tropical diseases are being studied at the Scripps Research Institute in California. Development of derivatives to combat protozoa is furthest along, however.

Tropical leishmaniasis

The most significant international cooperating party of the birch group is Professor **Charles Jaffe** from the Hebrew University of Jerusalem. Jaffe has tested the effectiveness of betulin derivatives against protozoan parasites from the genus *Leishmania*, which cause the tropical disease leishmaniasis.

Leishmaniasis is globally significant illness for which no effective, safe, and inexpensive medication exists.

"Leishmaniasis is prevalent primarily is poor developing countries, so the disease has received little attention. For this reason as well, it is a good subject for university-led pharmaceutical research," says Yli-Kauhaluoma.

Betulin derivatives may offer a new weapon in the fight against the protozoa causing leishmaniasis, but more research is needed to find a derivative that is effective enough.

"The results are promising, but there's still a long way to go before we'll see them on pharmacy shelves," Yli-Kauhaluoma states.

The research group for pharmaceutical chemistry has several EU initiative applications pending for birch research. The derivatives that have been prepared are included in the recently announced group of five patent applications regarding new chemical derivatives for betulin.

Professor Jari Yli-Kauhaluoma is excited by the possibilities of birch bark research.

New tools for drug discovery through multidisciplinary research

The University of Helsinki's Drug Discovery and Development Technology Center (DDTC) investigates and generates new methods of drug development. Professor **Arto Urtti** leads the centre, which is a cooperative unit within the Faculty of Pharmacy.

The research conducted at the centre offers supplementary information about medicinal substances at the early development stages. Their work is in high demand, as, according to Urtti, over 90% of investigational drugs that make it to clinical testing fail. The current form of the unit is still relatively new, as the centre received permanent status as an independent organisation only in 2006. In 2007, the unit's efforts were targeted more clearly according to the recommendations of an international panel.

Domestic and international cooperation

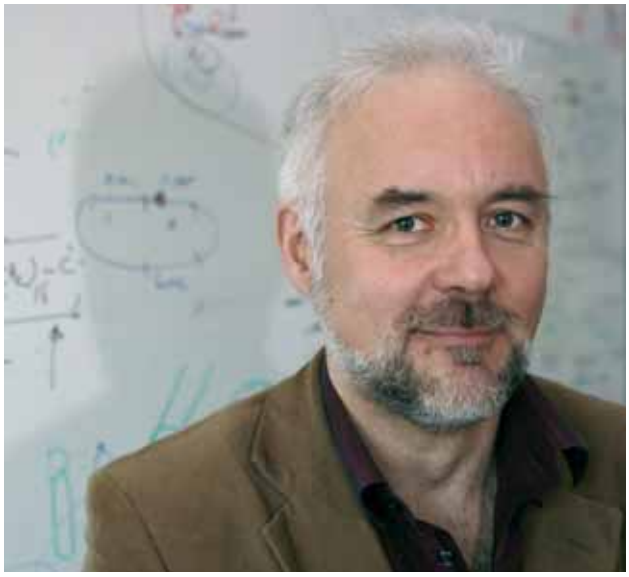
Urtti explains that the centre works closely with both the pharmaceutical industry and the divisions of the Faculty of Pharmacy. It trains researchers and provides basic pharmaceutical education. Many EU-funded projects requiring stakeholder cooperation are currently underway. During 2007, the centre produced 55 original publications in international journals, and five patent applications were submitted.

The centre is international at many levels: over a quarter of the 40 employees working in the six research groups are foreign. The majority of lecturers for the popular seminar series come from abroad. The centre is also one of the educational institutions involved in the international Euro-PhD in Advanced Drug Delivery; participating researchers complete a portion of their doctoral studies at the DDTC.

Drug discovery tools and pharmaceutical nanotechnology

According to Urtti, the research work is divided into two primary channels, the first being development of drug discovery tools. Computer models, cellular models, and analytic methods provide valuable supplementary data about drug substances at the early development stages. The tools enable selection of the best compounds for testing in humans.

Urtti mentions the development of a miniaturised microtechnology-based analytical chip as one of the year's highlights. This new technique can be used for example to rapidly detect drugs and their metabolites. It also builds a platform for faster and more efficient analysis of drug substances.



Professor Arto Urtti leads the Drug Discovery and Development Technology Center.

The other primary field of research is pharmaceutical nanotechnology, which facilitates drug delivery. For instance, delivery of gene-based drugs into the body is currently not efficient enough. Nanoparticles are necessary carriers that assist drug transport to their destinations in the body. The stages and mechanisms used by nanoparticles to move genes to their destinations have been studied, and the crucial significance of gene release from the nanoparticles in comparison to other stages has been demonstrated. Urtti also notes the development of a light-activated drug delivery system, which relies on a light signal to release medication, as a major achievement for 2007.

The DDTC has, through personnel decisions made in recent months, more clearly focused its efforts on drug discovery tools and pharmaceutical nanotechnology. In the coming years, the DDTC will concentrate on building a solid network of international experts to support the growth of its research groups. The establishment of a core laboratory for the research of bioactivity is planned for the near future. The procurement of new methods and equipment has been supported by many of the faculties and other units in the Viikki campus.

Social pharmacy offers a window onto society

In the field of social pharmacy, drugs and their use are examined from a societal perspective. The third mission of the university, societal interaction, is an essential element of research and instruction. The new Division of Social Pharmacy has deliberately taken steps towards health and drug policy-making in teaching and research.

Learning about political processes

Professor **Marja Airaksinen** explains that exploring questions of medication and patient safety, for instance, is part of the curriculum. The appropriateness and safety of medical drug use is examined holistically.

"The pharmaceutical industry sells and markets its products effectively, which necessitates the existence of controlling and preventive mechanisms that make medicine use safe and rational."

The goal is that students form a basic understanding of drug policy decision-making in Finland and at the EU level and how this reflects on practical work in pharmacies, hospital pharmacies and the pharmaceutical industry. Learning about the political process is part of studies from the first year, during which students e.g., visit the Parliament.

Social pharmacy builds bridges

The division has close ties to the key interest groups in the field. These include the National Agency for Medicines, the Social Insurance Institution, the Association of Finnish Pharmacies and the Finnish Pharmacists' Association, pharmaceutical continuing education centers as well as various national committees.

"Cooperation with pharmacy and hospital pharmacy practitioners is also tight. We participate in the development of medication counselling and drug information services and medication review procedures.

Cooperation is directed increasingly at health care in general and at issues related to patient and medication safety in particular. Airaksinen belongs to the patient safety steering group of the Ministry of Social Affairs and Health; this involvement has led to many thesis topics and even to new directions for division research.

One of the division's strengths is its international approach. Current cooperation is directed more and more often at influential parties in health policy. Airaksinen is a member of international working groups, one of the most central having been the medication safety working group of the Council of Europe (2003–2006). At the moment she represents Finland in the EU Pharmaceutical Forum's patient information working group. Of the field's international networks, the most significant for the division is FIP, the International Pharmaceutical Federation, in which both Airaksinen and university lecturer **Simon Bell** participate actively.

Professor Marja Airaksinen says that the appropriateness and safety of medical drug use is examined holistically.

Results of 2007

In terms of societal interaction, the most significant achievement for the division in 2007 was the publication of the Council of Europe's report on medication safety. The report covers the state of medication safety in Europe and is intended both for official and instructional use. It provides recommendations for action in areas critical to medication safety.

"Participation in creation of the report has resulted in a wide variety of cooperative efforts directed at drug and patient safety."

"Previously there was no common terminology for issues related to patient safety, so a drug and patient safety glossary was commissioned and published by the National Research and Development Centre for Welfare and Health (STAKES) and the Centre for Pharmacotherapy Development (Rohto). I participated in defining the terms in the glossary, as did many of our students. Since the creation of the glossary, national cooperation has continuously taken on new forms," says Airaksinen.

The Council of Europe's report on medication safety:
www.gs1health.net/downloads/medication.safety.report.2007.pdf.

Studying the central nervous system

Professor **Raimo K. Tuominen**, Head of the Division of Pharmacology and Toxicology, indicates that almost all research conducted in the division concentrates on neuropharmacological studies and shares a common denominator in behaviour and brain neurochemistry, including observation of changes in neurotransmitters following various drug treatments.

The Division has the resources to conduct modern neuropharmacological research, for example an up-to-date surgical theatre and extensive equipment for modelling Parkinson's disease.

The effects of drug substances are studied at the molecular level and in experimental animals; both are necessary in neuropharmacological research. Tuominen emphasises the importance of cooperation between units housed at the Viikki campus.

"Cooperation with other units is close. For instance, we have been able to take advantage of equipment belonging to the Neuroscience Center and have long enjoyed fruitful cooperation with the Institute of Biotechnology."

A new neurotrophic factor presented in Nature

The climax of 2007 was an article published in *Nature* that was significant in terms of a possible new treatments strategy for Parkinson's disease. The research group led by **Mart Saarma**, Director of the Institute of Biotechnology, discovered a new neurotrophic factor, Conserved Dopamine Neurotrophic Factor (CDNF). Together with the research group led by Raimo Tuominen, they were able to demonstrate that CDNF protects midbrain dopamine neurons from damage in experimental modelling of Parkinson's disease in rats. In addition to the protective effect, CDNF even facilitates the restoration of dopamine neuron functioning to earlier levels.

The most current research projects

Tuominen says that research on neurotrophic factors will continue on a broad front. One goal is gene therapy in which the factor gene is transfected to the brain: the CDNF produced by the gene could work like a protein injected into the brain. The neurotrophic factor research from the Viikki campus has also been noted by international funding organisations; among others the U.S.-based Michael J. Fox Foundation for Parkinson's Research has once again granted funding for continuing research into the new treatment method for Parkinson's.

Professor **Pekka T. Männistö** is a pioneer in the development of COMT inhibitors. The COMT inhibitor entacapone is a drug currently used in treatment of Parkinson's disease. The significance of the enzyme in other disease-type states is now being studied in the Division. The hope is that new information will be gained on COMT's relevance with regard to the causes of addiction-based diseases, the sensing of pain, and mental illnesses.

According to Professor Raimo K. Tuominen, the Division has the resources to conduct modern neuropharmacological research.

Researchers of the Division are participating in two large research programmes funded by the Academy of Finland. Research led by Professor Pekka Männistö, and conducted as part of the MAGLIN project of the Elvira programme, focuses on the significance of the POP enzyme (prolyl oligopeptidase) in coeliac disease. The general characteristics of mammalian POP, its significance in the central nervous system and its functioning with COMT are being researched in cooperative multi-location projects supported with funding from the Academy of Finland, foundations, and the University of Helsinki. Another major project funded by the Academy is part of the programme Substance Abuse and Addictions, a Finno-Russian research consortium led by Raimo K. Tuominen.

The EU Sixth Framework Programme project coordinated by Tuominen is continuing, bringing together 25 different research institutes from 12 countries. The topic of their research is the compounds affecting protein kinases; potential areas of application for this research are cancer chemotherapy and inflammatory diseases. Academy Professor **Kaarina Sivonen's** research group from the Faculty of Agriculture and Forestry, is also participating in this project.

The Faculty

The Faculty of Pharmacy comprises six divisions and an interdisciplinary research unit.

Division of Biopharmaceutics and Pharmacokinetics
www.helsinki.fi/farmasia/biofarmasia/index_en.html

Division of Pharmaceutical Biology
www.helsinki.fi/farmasia/pharmbiol/english/Engindex.html

Division of Pharmacology and Toxicology
www.helsinki.fi/farmasia/farmakologia/english/mainpage.htm

Division of Pharmaceutical Chemistry
www.helsinki.fi/farmasia/pharmchemistry/english/eng_chemistry.htm

Division of Pharmaceutical Technology
www.pharmtech.helsinki.fi/english/frontpage.htm

Division of Social Pharmacy
www.helsinki.fi/farmasia/sosiaalifarmasia/english

Drug Discovery and Development Technology Center (DDTC)
www.ddtc.helsinki.fi

Administration

Faculty council

The faculty council consists of the Dean and 10 other members, of whom four are professors, three belong to the teaching and other personnel group and three are students.

In 2007, faculty members (vice members) were as follows.

Professor, dean Raimo Hiltunen, chairman

Professor, vice dean Jouni Hirvonen	(Professor Jouko Yliruusi)
Professori Raimo Tuominen	(Professor Pekka T. Männistö)
Professor Marja Airaksinen	(Professor Arto Urtti)
Professor Risto Kostiainen	(Professor Jari Yli-Kauhaluoma)
University lecturer Mia Säkkinen	(Researcher Sanna Siissalo)
Senior researcher Marjo Yliperttula	(Assistant Kirsi Harju)
Secretary Elisa Sippola	(Laboratory technician Inkeri Huttunen)
Student Henri Autio	(Student Paula Juurinen)
Student Juho-Matti Renko	(Student Anni Svala)
Student Ira Vainikka	(Student Miia Eholuoto)

The faculty council had 11 meetings during the year.

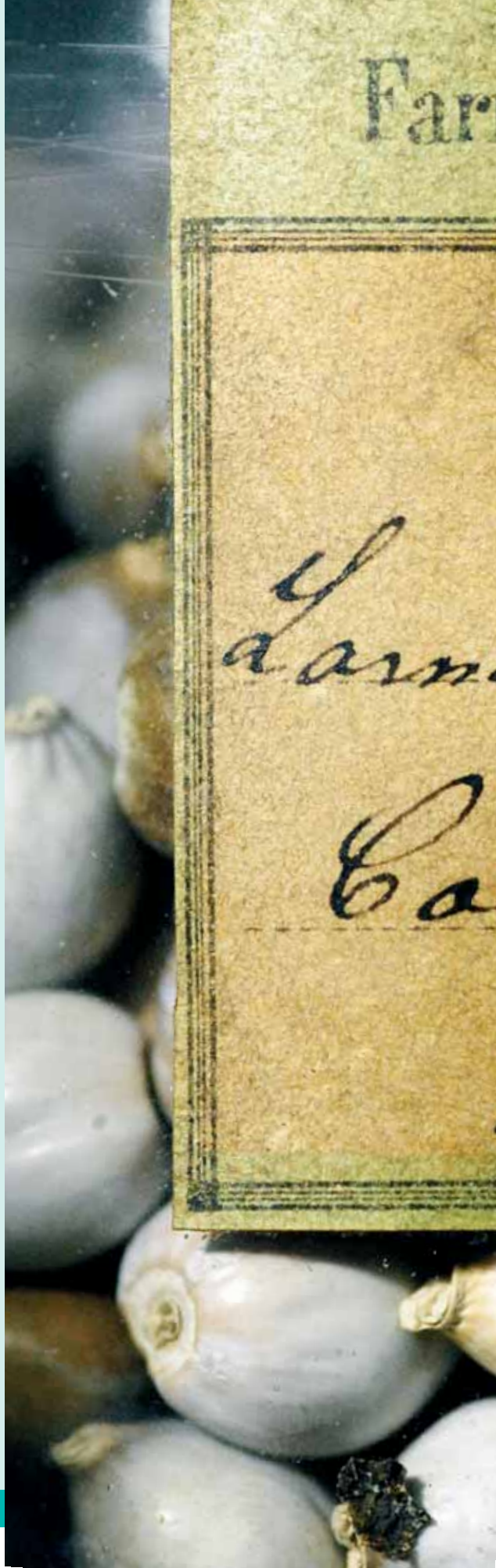
FACTS AND FIGURES (2007)

Students

	Women	Total
Lower degree	547	671
Higher degree	164	210
Postgraduate degree	78	104
Total	**789**	**985**

Degrees

	2003	2004	2005	2006	2007
B.Pharm.	197	152	150	193	166
M.Sc. (Pharm.)	48	37	39	40	45
Lic.Pharm.	13	3	4	-	1
Ph.D. (Pharm.)	11	7	7	9	9
Ph.D.			1	1	
Total	**269**	**200**	**201**	**243**	**221**



Doctoral thesis defended in 2007

Aaltonen, Jaakko
From Polymorph Screening to Dissolution Testing - Solid Phase Analysis during Pharmaceutical Development and Manufacturing

Alvesalo, Joni
Drug Discovery Screening and the Application of Genomics and Proteomics in the Drug Development Process for Chlamydia pneumoniae

Mirza, Sabiruddin
Crystallization as a Tool for Controlling and Designing Properties of Pharmaceutical Solids

Nuutinen, Saara
The Effects of Nicotine on the Regulation of Neuronal Alpha7 Nicotinic Acetylcholine Receptors and Intracellular Signalling Pathways

Salo, Piia
Thin-Layer Chromatography with Ultraviolet and Mass Spectrometric Detection: From Preparative-Layer to Miniaturized Ultra-Thin-Layer Technique

Sikanen, Tiina
SU-8-Based Microchips for Capillary Electrophoresis and Electrospray Ionization Mass Spectrometry

Stockmann-Juvala, Helene
Neuro- and immunotoxic effects of fumonisin B1 in cells

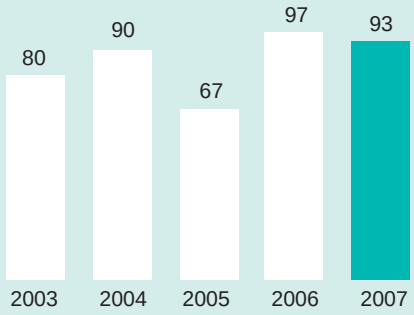
Vihola, Henna
Studies on Thermosensitive Poly(N-vinylcaprolactam) Based Polymers for Pharmaceutical Applications

Östman, Pekka
Microchip Atmospheric Pressure Ionization-Mass Spectrometry

Publications

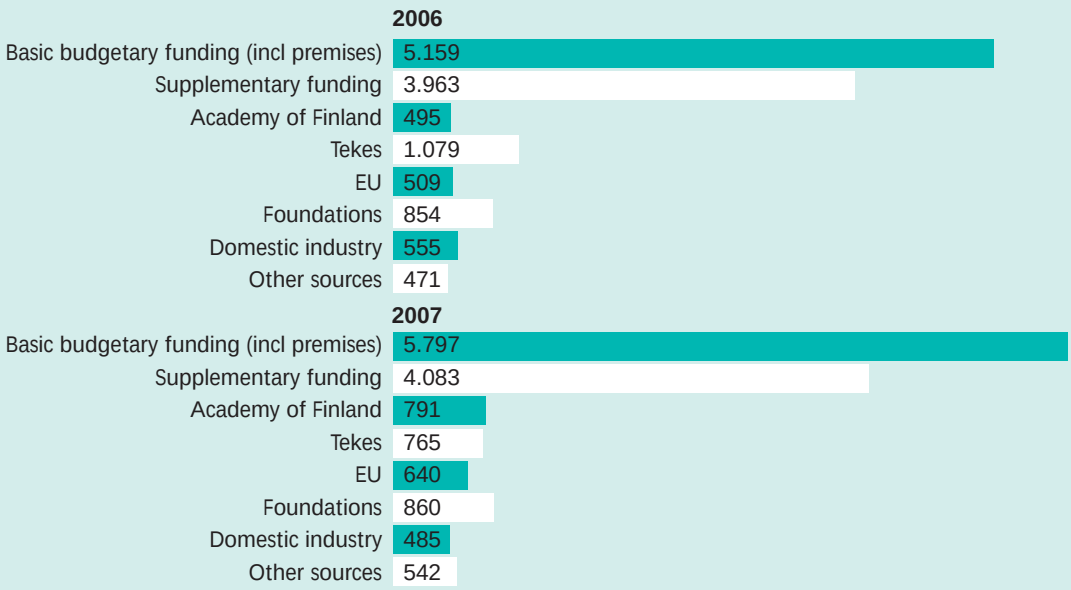
In 2007 the personnel of the Faculty of Pharmacy published 93 articles in scientific periodicals with referee system.

Articles in scientific periodicals with referee system



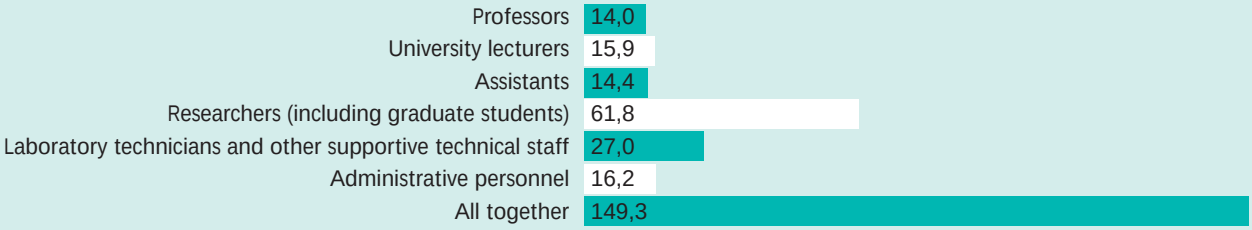
Detailed information can be found in the Helsinki University Knowledge Databases (http://www-db.helsinki.fi/osaamistietokannat/index.shtml).

Finances (k €)



Staff

Personnel in person years in 2007



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